

FORM PTO-7590 (Modified)
(REV 10-95)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

1475

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

09/744656

INTERNATIONAL APPLICATION NO.
PCT/DE 00/01585INTERNATIONAL FILING DATE
MAY 17, 2000PRIORITY DATE CLAIMED
JUNE 1, 1999 & FEB. 11, 2000

TITLE OF INVENTION

STARTER GENERATOR FOR NA INTERNAL COMBUSTION ENGINE AND METHOD FOR PRODUCING THE SAME

APPLICANT(S) FOR DO/EO/US

Torsten MANGOLD, Nicole WEHRLE, Juergen GLAUNING

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☐ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 18 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
A **SECOND** or **SUBSEQUENT** preliminary amendment.
16. ☐ A substitute specification.
17. ☐ A change of power of attorney and/or address letter.
18. ☒ Certificate of Mailing by Express Mail
19. ☐ Other items or information:

EF 215 952 856 US

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR

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1475

20. The following fees are submitted.:

CALCULATIONS PTO USE ONLY

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

- ☐ Search Report has been prepared by the EPO or JPO \$930.00
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) \$720.00
- ☐ No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) \$790.00
- ☒ Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$1,070.00
- ☐ International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) \$98.00

ENTER APPROPRIATE BASIC FEE AMOUNT =

\$1,000.00

Surcharge of \$130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).

\$0.00

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE
Total claims	18 - 20 =	0	x \$18.00
Independent claims	2 - 3 =	0	x \$80.00

\$0.00

\$0.00

Multiple Dependent Claims (check if applicable). ☐

\$0.00

TOTAL OF ABOVE CALCULATIONS =

\$1,000.00

Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable). ☐

\$0.00

SUBTOTAL =

\$1,000.00

Processing fee of \$130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).

\$0.00

TOTAL NATIONAL FEE =

\$1,000.00

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). ☐

\$0.00

TOTAL FEES ENCLOSED =

\$1,000.00

Amount to be:

refunded

\$

charged

\$

☐ A check in the amount of _____ to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **19-4675** in the amount of **\$1,000.00** to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **19-4675** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

STRIKER, STRIKER & STENBY
103 EAST NECK ROAD
HUNTINGTON, NEW YORK 11743

SIGNATURE

MICHAEL J. STRIKER

NAME

27233

REGISTRATION NUMBER

JANUARY 29, 2001

DATE

09/744656

JC92 Rec'd PCT/PTO 29 JAN 2001

UNITED STATES PATENT AND TRADEMARK OFFICE

Examiner:

Group:

Attorney Docket # 1475

Applicant(s) : MANGOLD, T., ET AL

Serial No. :

Filed : Simultaneously

For : STARTER GENERATOR FOR AN INTERNAL
COMBUSTION ENGINE AND METHOD FOR
PRODUCING THE SAME

SIMULTANEOUS AMENDMENT

January 29, 2001

Honorable Commissioner of Patents and Trademarks
Washington, D.C. 20231

S I R S:

Simultaneously with filing of the above identified application
please amend the same as follows:

In the Claims:

Claim 3 line 1 and 2 delete "one of the foregoing claims", substitute with "claim 1".

Claim 5 line 1 delete "one of claims 3 or 4", substitute with "claim 3".

Claim 6 line 1 and 2 delete "one of claims 3, 4 or 5", substitute with "claim 3".

Claim 7 line 1 delete "one of claims 5 or 6", substitute with "claim 5".

Claim 11 line 1 delete "one of claims 9 or 10", substitute with "claim 9".

Claim 12 line 1 delete "one of claims 9-11", substitute with "claim 9".

Claim 16 line 1 delete "one of claims 9-15", substitute with "claim 9".

Claim 17 line 1 delete "one of claims 9-16", substitute with "claim 9".

Claim 18 line 1 delete "one of claims 16 or 17", substitute with "claim 16".


REMARKS:

This Amendment is submitted simultaneously with filing of the above identified application.

With the present Amendment applicant has amended the claims so as to eliminate their multiple dependency.

Consideration and allowance of the present application is most respectfully requested.

Respectfully submitted,


Michael J. Striker
Attorney for Applicant(s)
Reg. No. 27233

5/11/13

09/744656

JC02 Rec'd PCT/PTO 29 JAN 2001

STARTER GENERATOR FOR AN INTERNAL COMBUSTION ENGINE
AND METHOD FOR PRODUCING THE SAME

5 The invention relates to a starter generator for
an internal combustion engine and to a method for
producing it, as defined by the characteristics recited
in claims 1 and 9.

Prior Art

10 From the prior art, starting systems for internal
combustion engines are known that as a rule comprise a
battery-operated DC motor (starter generator) as well as
switch gear and control units. For starting the engine,
a torque is transmitted by the starter generator. Otto
engines in general require rotary speeds of 60-100 rpm,
and diesel engines require rotary speeds of
approximately 80-200 rpm. In the course of progressive
reductions in weight and installation space as well as
improvements to the starting power, numerous
modifications of the starter system have been developed.
For instance, in so-called layshaft starters, by means
of one additional gear stage, a total step-up of an
armature torque generated by the starter generator can
be increased. However, the need still exists to reduce
weight and installation space, improve cooling power or
recycling capability, and reduce the number of
25 structural elements. Advantageous modifications of the
starter generator are therefore desired.

Advantages of the Invention

According to the invention, with the aid of the
starter generator and the method for producing it having

the characteristics recited in independent claims 1 and 9, an especially simple, economical production method on the one hand and a starter generator of reduced weight and installation space that is especially easy to adapt to customer requirements on the other can be made available. The starter generator has a rotor and a stator, whose structural elements substantially comprise stacked, joined- together metal sheets.

According to the method, the metal sheets that form the stator and the rotor are connected to one another by joining. The joining can be done by punch packing, welding, adhesive bonding or riveting. The individual metal sheets are pretreated and stacked on one another in such a way that the essential structural elements of the two components are at least maximally preshaped.

Preferably, the structural elements of the rotor, individually or combined, include a hub, a bearing seat, and a sensor ring for detecting rpm and/or the direction of rotation. If in addition short-circuit bars and/or short- circuit rings are created on the rotor, this can preferably be done by aluminum casting or copper casting.

With a suitable geometry of the metal sheets that form a stator after being joined, in particular such structural elements as a pin bore, a bore pattern and a cooling system can be created directly. In a preferred variant, part of the cooling system is formed by recesses on the outer edge of the stator. The recesses then serve in an ensuing production step to receive cooling tubes. In a preferred feature of such a cooling

system, the cooling tubes have knurling on their tube surface, which increases a retention force on a base body of the stator. For permanent fixation to the stator, the cooling tubes can also be press-fitted in it, or can initially merely be placed in the recess of the stator and then widened by means of a mandrel.

Alternatively or in a combination for this purpose, the cooling system can be accommodated in the interior of the stator (internal cooling), or the jacket faces of the cooling system are formed by an external edge of the stator and a gear bell that receives the stator (external cooling). For sealing off the cooling system, a sealing means, such as an electroplated coating, a heat-resistant and coolant-resistant paint, or a synthetic resin can be applied in the region of the jacket faces of the cooling system.

Further preferred features of the invention will become apparent from the other characteristics recited in the dependent claims.

Drawings

The invention will be described in further detail below in terms of exemplary embodiments in conjunction with the associated drawings. Shown are:

Fig. 1, one version of a starter generator in the form of an asynchronous machine, in a fragmentary perspective view;

Fig. 2, two fragmentary perspective views of a stator with a cooling system;

Fig. 3, two fragmentary perspective views of a rotor;

Fig. 4, a schematic sectional view of one region of a stator with internal cooling; and

Fig. 5, a schematic sectional view of one region of a stator with external cooling.

Description of the Exemplary Embodiment

Fig. 1 shows a starter generator 10 as it is mounted in the drive train between a crank shaft of an internal combustion engine and a downstream gear. This kind of crank shaft starter generator 10 can be designed as an asynchronous machine and typically comprises a stator 12 and a rotor 14 supported so as to be movable relative to it.

In Fig. 2, two fragmentary perspective views of the rotor 14 are shown. A base body 15 of the rotor 14 is produced by joining different metal sheets, for instance by means of punch packing technology. The base body 15 already contains all the essential structural elements of the rotor 14. Thus its geometry is defined in such a way that a bearing seat 16 forms on the inside diameter of the metal sheets of the rotor. The base body 15, on an inside, also has a radially inward-oriented set of teeth 17, which by way of example can be a starting point for detection of rpm and/or the direction of rotation using a sensor ring. On an outside of the base body 15, a further set of teeth 19 is created by means of a suitable embodiment of the metal sheets that form the base body 15. Short-circuit

elements, such as a short-circuit ring 18 and short-circuit bars 20, can be cast integrally onto this set of teeth 19 or so as to mesh with it. Recourse may be had to a copper or aluminum casting technique known per se; the first method makes a more favorable electrical efficiency possible. These methods can be performed directly on the base body 15.

The stator 12, shown in two different perspective views in Fig. 3, is likewise produced by stacking and joining different metal sheets. Once again, essential components of the stator 12 can be formed in one production process in this way. To that end, a base body 22 of the stator 12 already has a bore pattern required for receiving the rotor 14 by the time the individual metal sheets have been joined together. Furthermore, pin bores 24 and recesses 26 for receiving a cooling tube 28 (cooling system 27) can also be present. A heat transfer from the stator base body 22 to the cooling tube 28 can be improved by such provisions as knurling of the tube surface, press-fitting of the cooling tube 28 into the stator packet, or placing the cooling tube 28 in the stator packet and then widening it with a mandrel. Overall, local conditions can be taken into proper account quite flexibly in this way.

In Figs. 4 and 5, two further alternative cooling systems 27 for the stator 12 are shown, each in a schematic quarter-sectional view. Internal cooling (Fig. 4) can be realized by providing that the base body 22 is welded in the axial direction to two equal-sized metal end plates 29. An outer jacket face of the cooling system 27 is formed via a tubular segment 32

welded to the metal end plates 29. To assure tightness of the cooling system 27 with regard to a coolant liquid flowing through it in operation, a sealing means 36 is applied in the region of the jacket faces 34. The
5 sealing means 36 may be an electroplated coating, a heat-resistant and coolant-resistant paint, or synthetic resin. Overall, by this kind of integrated cooling, a structural volume and weight of the stator 12 can be reduced. Furthermore, its recycling capability
10 is enhanced by the illustrated limitation in the number of materials used, and cooling can be done with an especially favorable heat transfer.

Instead of the tubular segment 32, it is also possible, in a further alternative version of the stator 12, to use a wall 38 of a gear bell that receives the stator 12. If such an embodiment meets local requirements of the starter generator 10, a further weight reduction can then be attained in this way.

Claims

1. A starter generator for an internal combustion engine having a rotor and a stator, whose structural elements substantially comprise layered and joined-together metal sheets.

2. The starter generator of claim 1, characterized in that the structural elements of the rotor (14), individually or combined, include a hub, a bearing seat (16), and a sensor ring for detecting rpm and/or the direction of rotation.

3. The starter generator of one of the foregoing claims, characterized in that the structural elements of the stator (12), individually or combined, include a pin bore (24), a bore pattern, and a cooling system (27).

4. The starter generator of claim 3, characterized in that a part of the cooling system (24) is formed by recesses (26) on the outer edge of the stator (12), and the recesses (26) serve to receive cooling tubes (28).

5. The starter generator of one of claims 3 or 4, characterized in that the cooling system (27) is accommodated in the interior of the stator (12) (internal cooling).

6. The starter generator of one of claims 3, 4 or 5, characterized in that the cooling system (27) is accommodated on the outer edge of the stator (12), and an outer jacket face (34) of the cooling system (27) is

formed by a wall (38) of a gear bell (external cooling).

7. The starter generator of one of claims 5 or 6, characterized in that for sealing off the cooling system (27), a sealing means (36) is applied in the region of the jacket faces (34) of the cooling system (27).

8. The starter generator of claim 7, characterized in that the sealing means (36) is an electroplated coating, a heat-resistant and coolant-resistant paint, or a synthetic resin.

9. A method for producing a starter generator for an internal combustion engine having a rotor and a stator, in which the essential structural elements of the rotor and stator are formed by joining layered metal sheets.

10. The method of claim 9, characterized in that the joining is done by punch packing, welding, adhesive bonding or riveting.

11. The method of one of claims 9 or 10, characterized in that short-circuit bars (18) and/or short-circuit rings (20) are created on the rotor (14) by aluminum casting or copper casting.

12. The method of one of claims 9-11, characterized in that a geometry of the metal sheets for the stator (12) is selected such that after the metal sheets have been stacked on one another, recesses (26) are present, into which cooling tubes (28) are placed.

13. The method of claim 12, characterized in that

the cooling tubes (28) have a knurling on their tube surface, which increases a retention force on the stator (12).

14. The method of claim 12, characterized in that the cooling tubes (28) are press-fitted into the stator (12).

15. The method of claim 12, characterized in that the cooling tubes (28) are placed in the recesses (26) of the stator (12) and are then widened by means of a mandrel.

16. The method of one of claims 9-15, characterized in that the geometry of the metal sheets for the stator (12) is selected such that after the metal sheets have been stacked on one another, a cooling system (27) in the interior of the stator (12) is embodied (internal cooling).

17. The method of one of claims 9-16, characterized in that the geometry of the metal sheets for the stator (12) is selected such that after the metal sheets have been stacked on one another, a cooling system (27) is embodied on the outer edge of the stator (12), and an outer jacket face (34) of the cooling system (27) is formed by a gear bell (external cooling).

18. The method of one of claims 16 or 17, characterized in that a sealing means (36) is applied in the region of the jacket faces (34) of the cooling system (27).

Abstract

The invention relates to a starter generator for an internal combustion engine having a rotor and a stator, whose structural elements substantially comprise stacked, joined- together metal sheets.

5

(Fig. 1)

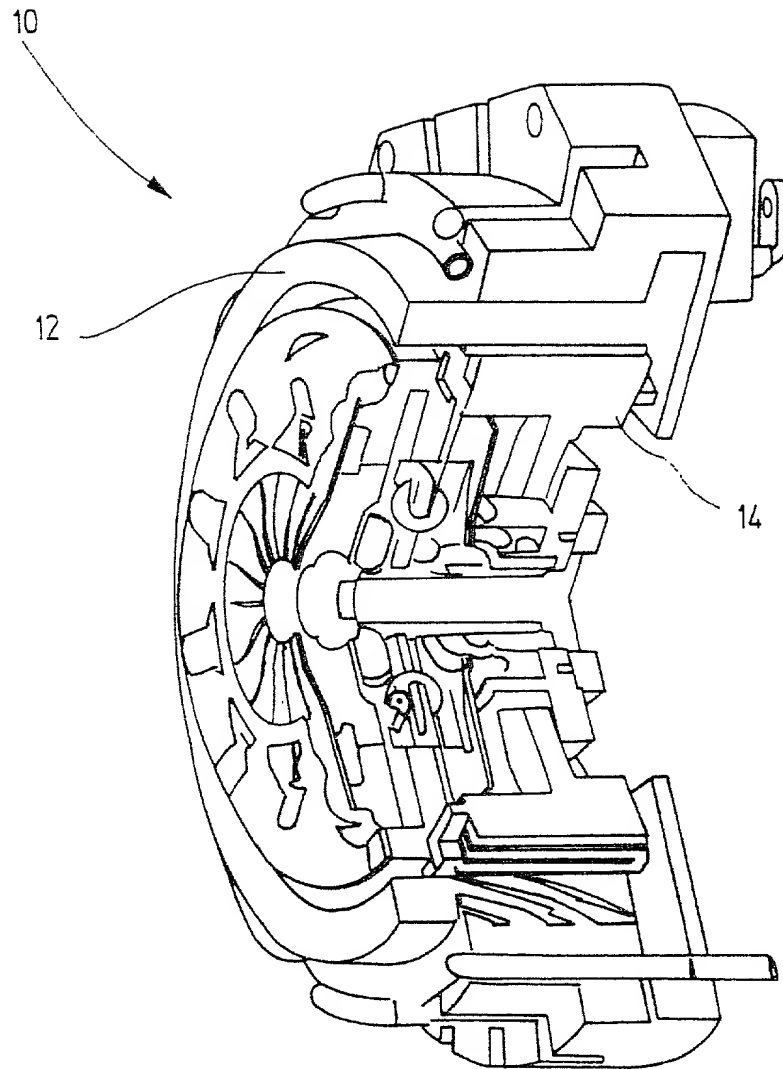


Fig.1

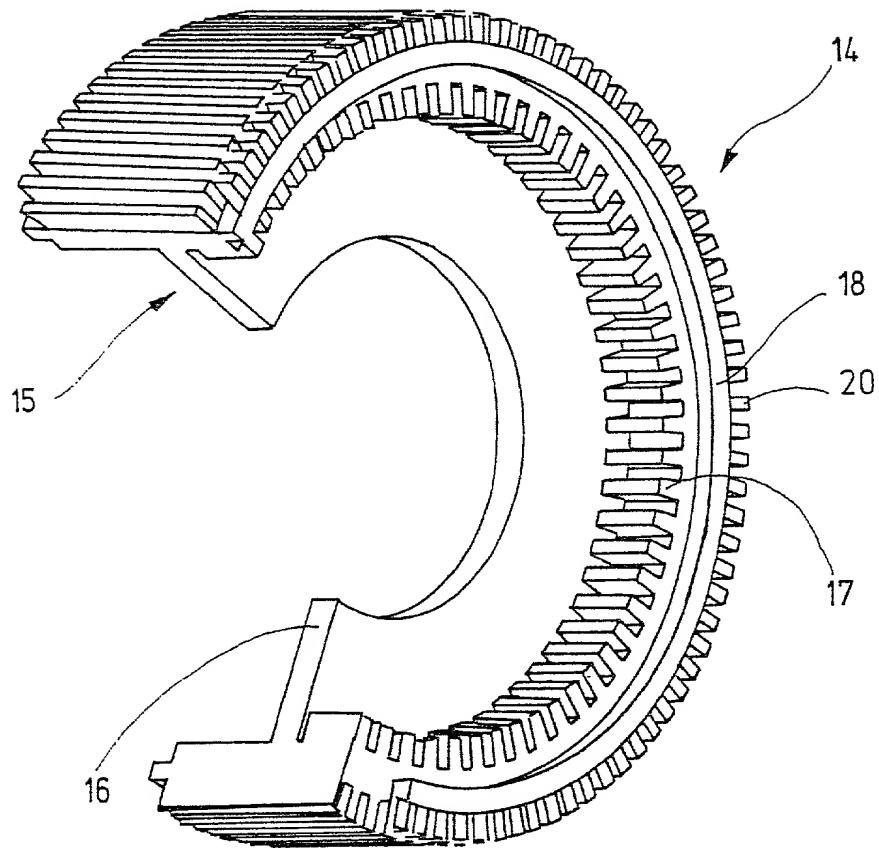


Fig.2

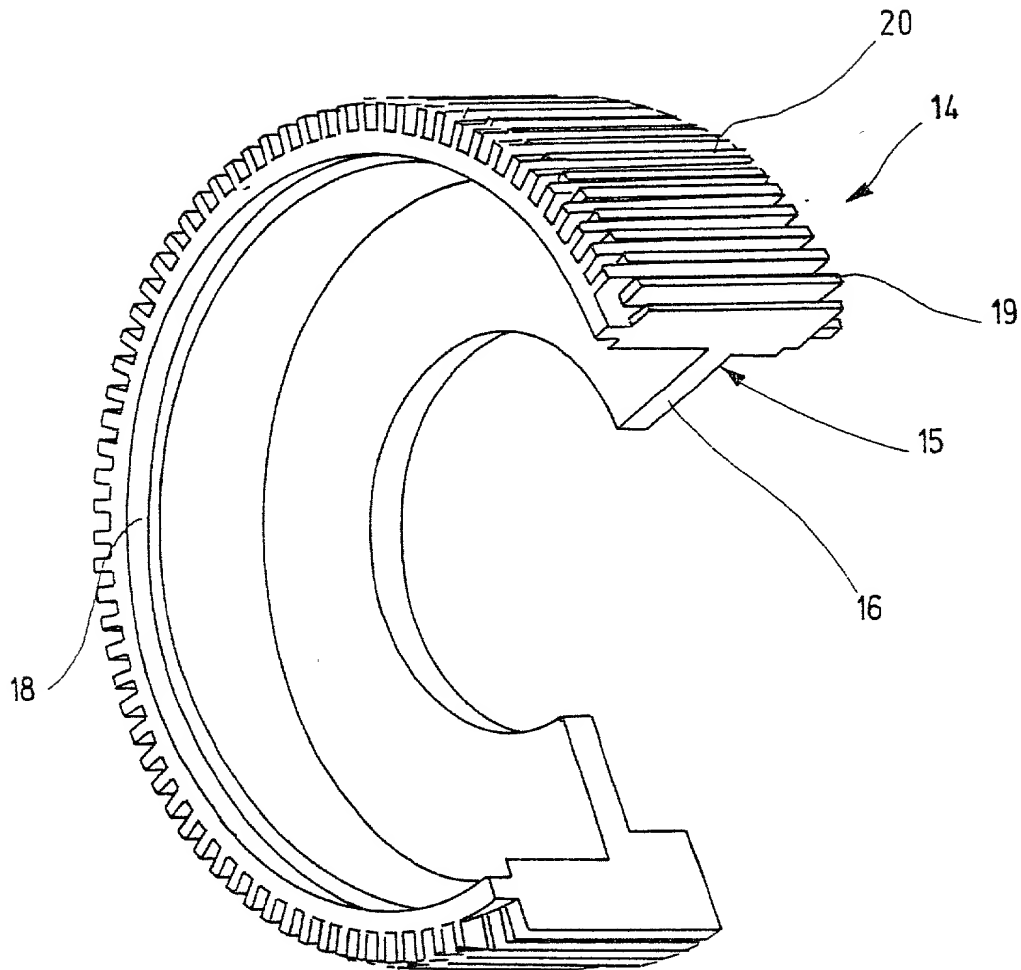


Fig.2

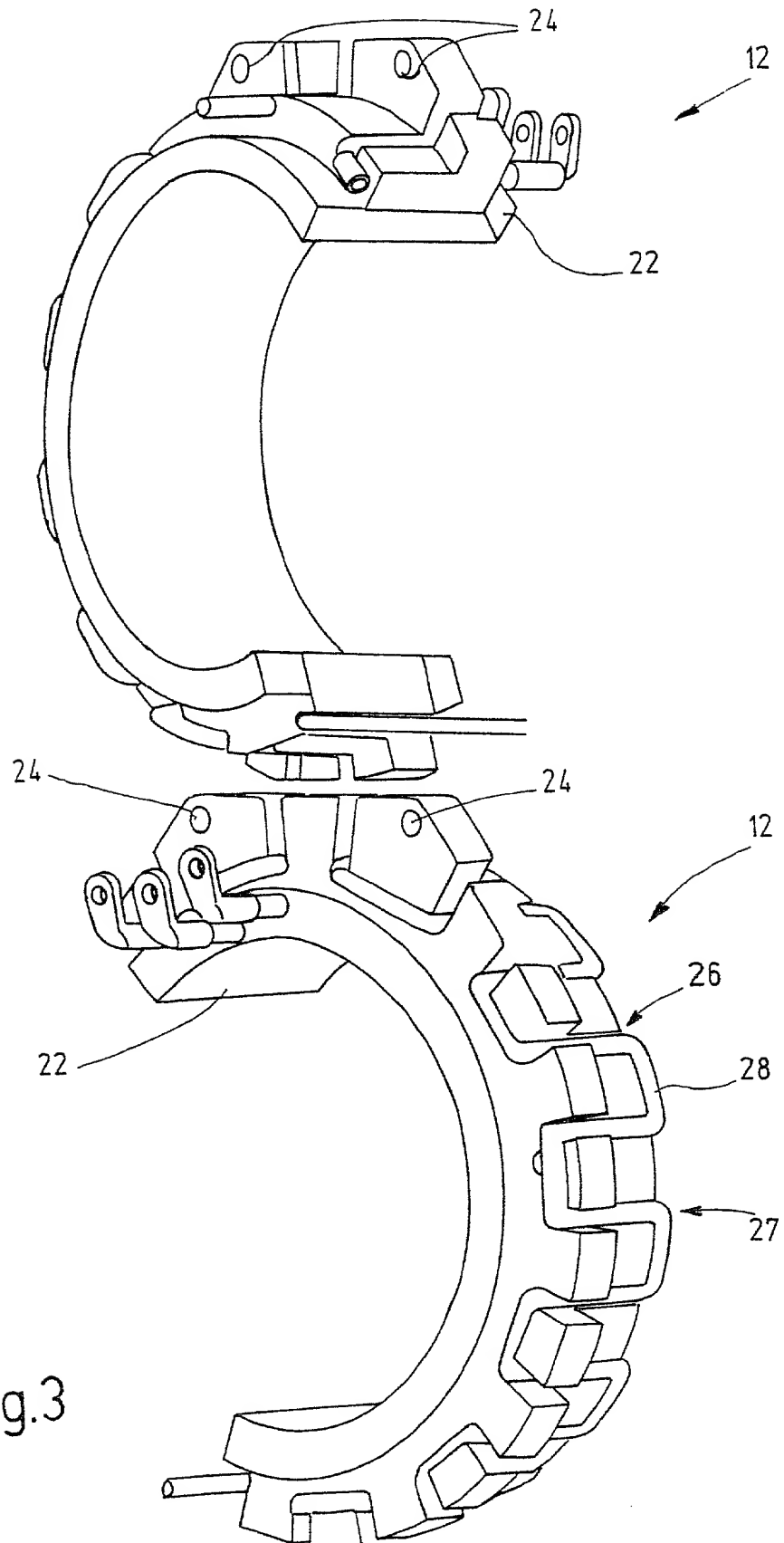


Fig.3

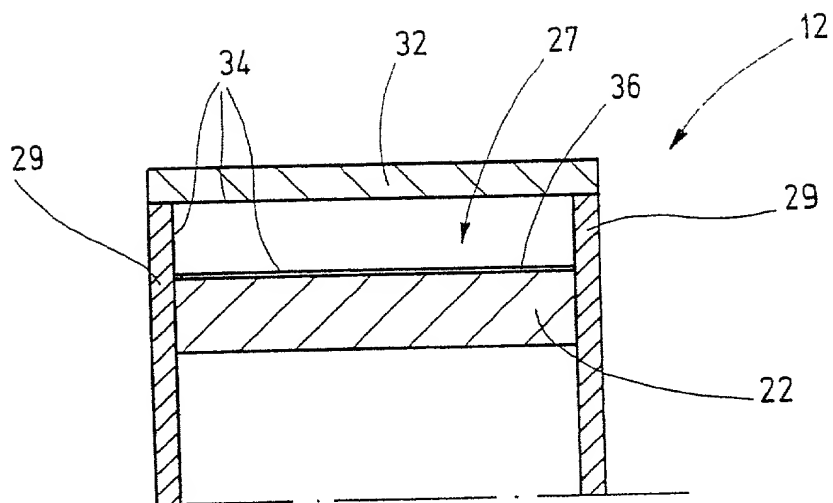


Fig.4

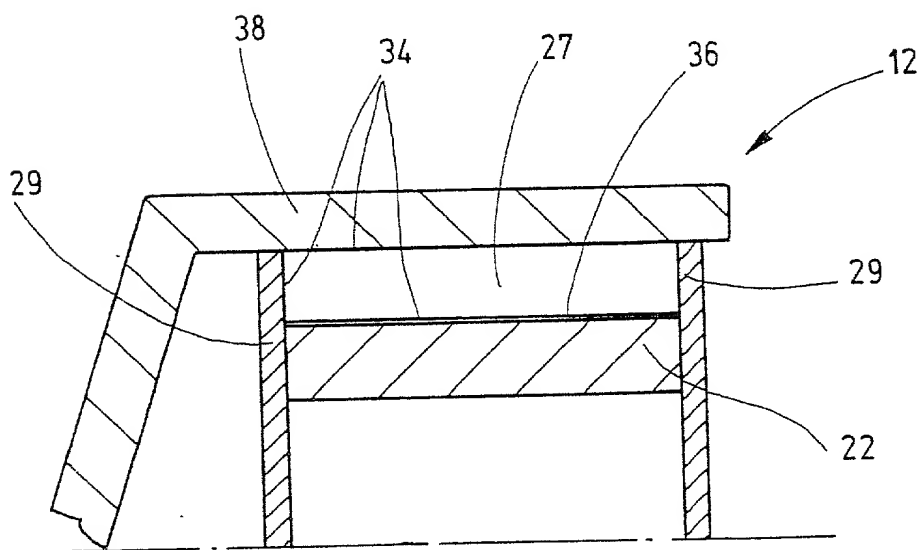


Fig.5

MAR 2001

R.3608-1

09/11/4656

DECLARATION AND POWER OF ATTORNEY FOR NATIONAL STAGE OF PCT PATENT APPLICATION

As a below-named inventor, I hereby declare that:

Torsten MANGOLD
Nicole WEHRLE
Juergen GLAUNING

My residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled **STARTER GENERATOR FOR AN INTERNAL COMBUSTION ENGINE AND METHOD FOR PRODUCING THE SAME** the specification of which was filed as PCT International Application number PCT/DE 00/01585 on May 17, 2000.

I hereby state that I believe the named inventor or inventors in this Declaration to be the original and first inventor or inventors of the subject matter which is claimed and for which a patent is sought.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose all information which is material to the patentability of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d) or Section 365 (b) of any foreign application(s) for patent or inventor's certificate, or Section 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed.

Prior foreign application(s):

Priority claimed:

<u>199 25 114.2</u>	<u>GERMANY</u>	<u>JUNE 1, 1999</u>	<u>X</u>	
(Number)	(Country)	(Date filed)	Yes	No
<u>100 06 002.1</u>	<u>GERMANY</u>	<u>FEBRUARY 11, 2000</u>	<u>X</u>	
(Number)	(Country)	(Date filed)	Yes	No

As a named inventor, I hereby appoint the following attorney to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:


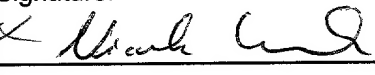

Michael J. Striker, Reg. No. 27233

Direct all telephone calls to Striker, Striker & Stenby at telephone no.: (631) 549 4700 and address and all correspondence to:

STRIKER, STRIKER & STENBY
103 East Neck Road
Huntington, New York 11743
U.S.A.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that wilful false statements and the like so made are punishable by fine or imprisonment,

or both, under Section 1001 of Title 18 of the United States Code and that such wilful false statement may jeopardize the validity of the application or any patent issued thereon.

Signature: 	Date: 31.01.01	Residence and Full Postal Address: Adalbert-Stifter-Weg 13 71522 Backnang Germany DEX
Full Name of First or Sole Inventor: Torsten MANGOLD	Citizenship: GERMAN	
Signature: 	Date: 01.02.01	Residence and Full Postal Address: Bergstrasse 37 Opweller Weg 31 71686 Remseck Germany DEX
Full Name of Second Inventor: Nicole WEHRLE	Citizenship: GERMAN	
Signature: 	Date: 01.02.01	Residence and Full Postal Address: Gartenstrasse 19 71711 Steinheim Germany DEX
Full Name of Third Inventor: Juergen GLAUNING	Citizenship: GERMAN	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fourth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Fifth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Sixth Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Seventh Inventor:	Citizenship:	
Signature:	Date:	Residence and Full Postal Address:
Full Name of Eighth Inventor:	Citizenship:	